

Upgradation of ITIs into Centers of Excellence-Broad guidelines for implementation of the scheme for Sector

Fabrication (Fitting & Welding)

These Centres will be providing multiskill training to meet the skill requirement of particular sector of industry with their active involvement in all aspects of training. The training will be provided in three parts as given below:

- ✓ Training in Basic skill areas for a period of one year.
- ✓ Training in Advanced modules of six months duration after Broad based basic Training(BBBT)
- ✓ The testing & certification for the Broad Based Basic Training & Advanced Module will be conducted by NCVT
- ✓ Training in specialized modules mainly in the industry(The course curricula, duration etc will be designed in consultations with the IMC/local industry). The trade testing & certification for specialized module will be done jointly by the State Government & Industry. Said certificate will have recognition from NCVT

As per the recommendations of the EFC, Training in the shop floor should constitute atleast 25-40% of the curriculum.

The training programme will have multi-entry and multi-exit provisions as given below:

- ✓ trainee can opt to go to the labour market after completing broad based basic training of one year duration or after completing advanced module.
- ✓ trainee can come back after some time to seek admission for advanced/ additional advanced /specialised module

Training in Advanced modules

- After the BBBT of one year duration, for subsequent training in Advanced Module, a CoE may select minimum three modules, so as to ensure that all the 96 trainees could be accommodated in the three modules in two shifts each.
- If it is felt that available modules are not sufficient to cater to the needs of local industry in a particular state, States may develop suitable module(s) accordingly in consultations with the industry & forward the same to DGE&T for seeking approval of NCVT.
- A trainee at a time can opt only for one module of 24 weeks duration.

Admission Criteria, Space requirement, Qualification of instructor of the various modules of " sector **Fabrication (Fitting & Welding)** are attached herewith.

Facilities for passed out trainees from Conventional Pattern for admission in Advanced module.

Subject to availability of seats, NTC /NAC passed outs from conventional system of the trades mentioned against each advanced module in the enclosed statement, could be offered admission accordingly.

MODULE NO.	NAME OF THE MODULE	Admission criteria	Space requirement	Duration In Weeks	Qualification/Status Of Instructor
FAT-01	TIG / MIG WELDING	Completed BBBT in Fabrication (<i>Fitting & Welding</i>) sector OR NTC/NAC in Welding OR Diploma in Mechanical Engg/ Production Engg	80 sq m	24 weeks	Degree in Fabrication/Mechanical/Production Engg with minimum three years teaching/industrial experience in the relevant field OR Diploma in Fabrication/ Mechanical/Production Engg with min five years teaching/industrial experience in the relevant field
FAT-02	STRUCTURAL / PRESSURE PARTS FITTING	Completed BBBT in Fabrication (<i>Fitting & Welding</i>) sector OR NTC/NAC in relevant trades OR Diploma in Mechanical Engg/ Production Engg			
FAT-03	STRUCTURAL WELDING	Completed BBBT in Fabrication (<i>Fitting & Welding</i>) sector OR NTC/NAC in Welding OR Diploma in Mechanical Engg/ Production Engg			
FAT-04	PRESSURE VESSEL and PIPE WELDING	Completed BBBT in Fabrication(<i>Fitting & Welding</i>) sector OR NTC/NAC in Welding OR Diploma in Mechanical Engg/ Production Engg			
FAT-05	WELDING INSPECTION and TESTING	Completed BBBT in Fabrication(<i>Fitting & Welding</i>) sector OR NTC/NAC in Welding OR Diploma in Mechanical Engg/ Production Engg			

I N D E X

UPGRADATION OF ITIs INTO CENTRES OF EXCELLENCE (CoE)

SECTOR / AREA : FABRICATION (Fitting & Welding)

ADVANCED MODULE IN II YEAR (FOR THE FIRST 6 MONTHS OF II YEAR)

MODULE NO.	NAME OF THE MODULE	DURATION IN WEEKS
I	TIG / MIG WELDING	26 weeks
II	STRUCTURAL / PRESSURE PARTS FITTING	- do -
III	STRUCTURAL WELDING	- do -
IV	PRESSURE VESSEL and PIPE WELDING	- do -
V	WELDING INSPECTION and TESTING	- do -

UPGRADATION OF ITIs into CENTERS of EXCELLENCE (CoE)

SECTOR / AREA : FABRICATION (Fitting & Welding)

ADVANCED MODULE IN II YEAR (FOR THE FIRST 6 MONTHS OF II YEAR)

MODULE - I: TIG / MIG WELDING (Duration - **26 weeks**)

MODULE - I: TIG / MIG WELDING

(Duration - 26 weeks)

I) COURSE CONTENT

Week No.	Practical	Theory
1,2	<ul style="list-style-type: none"> - Familiarisation with the machinery used in the trade - Introduction to safety equipment and their use - Setting up of Gas welding plant. - Depositing bead by Gas welding - Square butt, T & Corner joints on MS sheet in down hand position 	<ul style="list-style-type: none"> - Outline of the subjects to be covered - Introduction to various types of welding process, classification and applications - Advantages and limitation - Terms & definitions applied to welding - Explanation with simple sketches of various types of joints - Welding symbols - Welding Techniques
3,4	<ul style="list-style-type: none"> - Gas cutting of MS plate - Plasma cutting of SS sheets & Aluminum plates - Cutting of sheet metal to size - Bending of sheet metal into various curvatures 	<ul style="list-style-type: none"> - Gas welding principles and applications - Safety in Oxy-acetylene welding and cutting - Types of Flames and their uses - Gas welding, brazing & soldering procedures. - Gas cutting principles - Plasma cutting principles and advantages - Welding fixture and manipulators - Manual metal arc cutting & Gouging - Carbon Arc cutting and gouging
5,6	<ul style="list-style-type: none"> - Straight line beads on M S plate by SMAW - Weaved bead on M S plate by SMAW - Square butt joint on M S plate in down hand position by SMAW - Fillet weld on Tee joint and Lap joint in down hand position by SMAW - Fillet weld open corner joint on MS plate in down hand position by 	<ul style="list-style-type: none"> - Principles of Shielded metal Arc welding (SMAW) - Basic Electricity of welding power source - AC / DC power source advantages and disadvantages. - Arc and its characteristics - Polarity types & Arc length - Electrode – Types, description & Specification – BIS, AWS, etc..

	SMAW - Single V butt joint on MS flat in down hand position by SMAW	- Functions of flux & Characteristics of flux - Selection of electrodes and coating factors
7,8	- Setting up TIG welding plant. - Beading practice on MS sheet by TIG - Square butt and corner joint on MS by TIG in down hand position - Edge preparation of plates & pipes - Fitting of joint plates for TIG Welding	- Introduction to TIG welding - TIG welding equipments - Advantages of TIG welding process - Power source – Types, polarity and application - Accessories - HF unit and DC suppressor.
Week No.	Practical	Theory
9,10	- Beading practice on SS by TIG - Square butt and corner joint on SS by TIG - Welding of SS with back purging Technique. - Beading practice on Aluminum by TIG - Butt, T and Corner joint on Aluminum sheet by TIG - Single V butt joint on Aluminum sheet by TIG	- Tungsten electrode, Types, sizes, and uses. - Type of shielding gases - Square wave concept and Wave balancing. - Advantages of root pass welding of pipes by TIG welding - Purging Methods - Tables / Data relating to TIG welding. - Different type of weld joints- plates & pipes
11,12	- Root pass welding in plates by TIG in 1G, 2G, 3G & 4G - Root pass cleaning / Dressing up - Intermediate and cover pass welding of plates by SMAW - Root pass welding of pipes by TIG in 5G & 6 G - Intermediate and cover pass welding of pipes by MMAW. - Pipe Flange welding by TIG & ARC	- Pipes classification and Pipe schedule - Difference between pipe welding and plate welding - Edge preparation and tack welding procedure - Welding positions and its significance. - Plate welding procedure in 1G, 2G, 3G & 4G positions. - Pipe welding procedure in 5G & 6G. - Root pass welding Procedure of pipe by TIG welding - Pipe welding intermediate and Cover pass by SMAW - Procedure
13, 14	- Straight line beads on MS plate by CO ₂ welding - Lap T & corner joint on MS plate by CO ₂ welding in down hand position	- MIG / MAG welding - Power source & accessories - Wire Feed unit

	<ul style="list-style-type: none"> - Single 'V' butt joint by CO₂ welding in down hand position - Single 'V' butt joint by Argo shield welding 	<ul style="list-style-type: none"> - Welding Gun & its parts - Modes of metal transfer – Dip, Globular, spray & pulsed transfer and its significance
Week No.	Practical	Theory
15,16	<ul style="list-style-type: none"> - Double 'V' joint by Flux cored Arc welding - Lap T & corner joint on MS sheet in vertical down ward position by CO₂ welding - Lap T & corner joint on MS sheet in horizontal position by CO₂ welding - Lap T & corner joint on MS sheet in overhead position by CO₂ welding 	<ul style="list-style-type: none"> - Welding wire types and specification - Types of shielding gases - Argo shield gas - advantages - Flux cored arc welding
17,18	<ul style="list-style-type: none"> - Square butt and T joint on SS sheet by MIG welding - Single 'V' and fillet joint on Aluminum plate by MIG welding 	<ul style="list-style-type: none"> - Trouble shooting in MIG welding - Data and Tables related to Co₂ welding - Basic welding metallurgy - Weldability of metals - Preheating and Post heating - Distortion and methods of control
19,20	<ul style="list-style-type: none"> - Single 'V' joint on MS plate by SAW - Fillet weld on MS plate by SAW - Micro plasma welding on SS sheets & Foils 	<ul style="list-style-type: none"> - Submerged Arc welding – Principles, application-Types of fluxes, welding head, power source and Parameter setting - Plasma welding - Micro Plasma welding – Principle & parameter setting - Welding automation, Robots in welding
21,22	<ul style="list-style-type: none"> - Dimensional inspection of weldments - Weld test specimen preparation - Visual inspection of weldments - Dye penetrant & Magnetic particle testing - Ultrasonic Testing - Radiographic film revealing 	<ul style="list-style-type: none"> - Types of weld defects, causes and remedy - Inspection & testing of weldments - Visual inspection methods - Inspection kits - universal gauge, Fillet gauge, etc. - Non-destructive Testing methods, PT, MPT, UT & RT - Destructive testing – Bend test & tensile test

Week No.	Practical	Theory
23,24	<ul style="list-style-type: none"> - WPS & PQR writing procedure - Weld test specimen preparation on plates and pipes according to Codes and standards - Testing of specimen according to codes and standards 	<ul style="list-style-type: none"> - Certification methods - Codes and standards - Structural welding codes - Pressure vessel welding codes - Welding procedure specifications (WPS) - Procedure qualification Record (PQR)
25,26	<i>Review and ALL INDIA TRADE TEST etc</i>	

II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees

Sl. No.	Description of tools	QTY
List of Hand Tools		
1	Gloves pair leather	17 Nos
2	Apron leather	17 Nos
3	Screen welding helmet type	17 Nos
4	Screen welding hand	17 Nos
5	Goggles pair welder	17 Nos
6	Hammer scaling 0.25 kg. With handle	17 Nos
7	Chisel cold flat 19 mm	17 Nos
8	Centre punch 9mm x 127 mm	17 Nos
18	Scriber 15 cm	17 Nos
19	Tongs holding 30 cm	17 Nos
20	Wire brush (S.S)	17 Nos

Sl. No.	Description of tools	QTY
9	Dividers 20 cm	17 Nos
10	Caliper outside 15 cm	17 Nos
11	Rule 60 cm two fold brass tipped to read inches and mm	17 Nos
12	Wire brush (M.S)	17 Nos
13	Spark lighter	17 Nos
14	Chipping screen hand	17 Nos
15	Safety boots for welders	17 Nos
16	Safety goggles	17 Nos
17	Square blade 15 cm	17 Nos
39	"Tinmans" square 60cm x 30 cm	1
40	Welding torches with 10 nozzles	6 set
41	Earth clamps	12

List of Shop Outfit		
21	Brass Rule 30 cm or nickel chrome steel rule 30 cm	4
22	Hammer ball pin 1 Kg with handle	4
23	Chisel cold cross 9 mm	1
24	Screw Driver 25 cm blade and 20 cm blade	1 each
25	Leg vice on stand 150 mm	1
26	Number punch 6 mm and letter punch 6 mm	1 set
27	Hacksaw frame adjustable 30 cm	4
28	Hammering blocks 5 cm thick 60 sq	2
29	Magnifying glass x 6	4
30	Weld measuring gauge fillet and butt	2
31	File half round bastard 30 cm	6
32	File flat 35 cm rough	6
33	Spanner 12 mm and 15 mm double ended	4
34	Spanner D E 6 mm to 15 mm be 1.5 mm set of Nos.	1 set
35	Clamps 10 cm 15 cm 20 cm 30 cm	2 each
36	Hammer sledge double faced 3 Kg.	1
37	Pipe wrench 25 cm and 35 cm	1 each
38	Steel tape 182 cm flexible in case	1

60	CO ₂ welding machine complete 400 amps with gas cooled goose necked torch 300A	2 sets
61	Welding cables to carry 400 amps with flexible rubber	50 mte
62	Lugs for Cables	4 nos
63	PUG cutting machine	1
64	Gas welding table 822 x 92 cm + 60 cm fire bricks on stand	3

42	Pipe Cutter	1 set
43	Cutting torch Oxy-Acetylene with cutting nozzle	2 set
44	Heavy duty cutting, blow pipe with cutting nozzles	1 set
45	Electrode holder 400 amps	6
46	Welding rubber hose, oxygen and acetylene 8 mm	100 mte
47	Rubber hose clips	50
48	Spindle key (for opening cylinder valve)	8
49	Pressure regulator oxygen double stage	8
50	Pressure regulator acetylene Regulators	8
51	Tip cleaner	8
52	Glasses coloured 108 x 82 x 3 mm DIN 9A 11 A & 13 A	16 each
53	Glass white 108 mm x 82 mm	20 dozen
54	Outfit spanner	8
55	Rubber hose pipe black and red 5 mm	30 mte
56	Leather sleeves	16 pairs
List of General Installation		
57	Transformer welding set with all accessories 300 A	2 sets
58	Arc welding set Rectifier type 400 Amp. with all accessories.	2 sets
59	TIG welding set complete 300 amps AC / DC with water cooled torch	2 sets

76	Dye penetrant Testing kit	2 set
77	Magnetic particle Testing machine	1
78	Ultrasonic flaw detector	1
79	IIW / ASTM reference radiographic standard	1 set
80	Submerged Arc welding machine – 600 Amps	1

65	Arc welding table all metal with positioner	6	81	Micro plasma welding machine – 25 Amps	1
66	Trolley for cylinder (H P unit)	2	82	Impact testing machine	1
67	Gullitine shearing machine	1	83	Air plasma cutting system with standard accessories & compressor	1
68	D E grinder 30 cm wheel motorized Pedestal type	1	84	Universal Testing machine	1
69	Vice bench 10 cm	6	85	Personnel Computer with latest profile	1
70	Power hacksaw	1	86	Welding CDs (Processes and Inspection methods)	1 set
71	Electrode drying oven Temp. range 0-250° C, 10Kg capacity	1	87	Fibre Welding booth & welding screen	8 each
72	AG 7 Grinder & AG4	2 each	88	Fume extractors	4
73	Portable drilling machine (Cap. 6 mm)	1	89	Oxygen, Acetylene, Argon & Co ₂ cylinders	2 each
74	Welding helmets	16	90	Fire fighting equipment & First aid box	As reqd.
75	Steel lockers with 8 pigeon holes	2	91	Centre lathe swing over dia 10"	1

Workshop furniture		Qty
1	Suitable Work Tables with vices	As required.
2	Stools	17 Nos
3	Discussion Table	1 No
4	Tool Cabinet	2 Nos
5	Trainees locker	2 Nos
6	Fire fighting equipment, first aid box etc	As required
7	Book shelf (glass panel)	1 No.
8	Storage Rack	As required
9	Storage shelf	As required

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SECTOR / AREA : FABRICATION (Fitting & Welding)

ADVANCED MODULE IN II YEAR

(FOR THE FIRST 6 MONTHS OF II YEAR)

MODULE - II : STRUCTURAL / PRESSURE PARTS FITTING

(Duration - **26 weeks**)

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MODULE - II: STRUCTURAL / PRESSURE PARTS FITTING

(Duration - 26 weeks)

I) COURSE CONTENT

Week No.	Practical	Theory
1,2	<ul style="list-style-type: none"> - Familiarisation with the machinery / Hand tools used in the trade. - Introduction to safety equipment and their use - Handling of measuring instruments – Steel tape, Vernier caliper, Spirit level, Micrometer, Try square, Height gauge, Marking blocks, Bevel protractor etc. - Practice on marking various shapes on sheet metals - Development practice of surface of prism, cylinder, pyramids, cones, etc. 	<ul style="list-style-type: none"> - Outline of the subjects to be covered - Role of fabrication in industry - Basic Trigonometric calculations – Marking of Angles, Triangles, Square, Rectangle, Parallelogram, Hexagon, Octagon and Circles. - Calculation of volume and surface area of rectangular prism, cubes and cylinders - Development of right solids, prisms, cylinders, pyramids, cones, frustum of pyramid, cone etc.
3,4	<ul style="list-style-type: none"> - Marking on plates for drilling practice - Drilling required diameter hole - Marking on plates for beveling and chamfering - Milling - Using milling machine beveling and chamfering to required angle 	<ul style="list-style-type: none"> - Workshop practice – Hack sawing, Filing, Chipping, Hand grinding, Marking, Punching, Drilling, Tapping, Die-passing, etc. - Machine shop practice – Milling machine construction and operation – Milling cutter – Types of Milling etc. Lathe – construction and operation – Turning – Facing – Taper Turning – Threading etc. - Drilling machine – construction and operation feature
5,6	<ul style="list-style-type: none"> - Gas cutting of M.S. Plates - Angle cutting of plates for required bevel angle by Pug cutting machine - Practice on Plasma cutting system 	<ul style="list-style-type: none"> - Gas welding principles and application - Types of flames and their used - Gas cutting – straight line and profile - Gas cutting – Free hand, guided and mechanical - Manual Metal Arc cutting and gouging - Carbon Arc cutting and gouging

		<ul style="list-style-type: none"> - Plasma arc cutting principles
7,8	<ul style="list-style-type: none"> - Straight line beads on M S plate by SMAW - Weaved bead on M S plate by SMAW - Square butt joint weld on M S plate in down hand position by SMAW - Fillet, Tee and Lap joint weld in down hand position by SMAW - Fillet weld open corner joint on MS plate in down hand position by SMAW - Single V butt joint on MS flat in down hand position by SMAW 	<ul style="list-style-type: none"> - Principles of Shielded metal Arc welding (SMAW) - Basic Electricity of welding power source - AC / DC power source advantages and disadvantages. - Arc and its characteristics - Polarity types & Arc length - Electrode – Types, description & Specification – BIS, AWS, etc.. - Functions of flux & Characteristics of flux - Selection of electrodes and coating factors
9,10	<ul style="list-style-type: none"> - Identification of metals, bars, plates, flats, channels, I section, T section, and box section etc. - Study of design drawing related to structural and pressure parts and preparation of fitting square. 	<ul style="list-style-type: none"> - Metals used in fabrication - Types of fabrication joints - Types and classification of steel and application - Framed structures – shell structure – Rolled sections, I section, channel section, angle section, T-section - Welding symbols - Structural / Pressure vessel design drawing reading and understanding the concepts
11,12	<ul style="list-style-type: none"> - Using guillotine sheering machine, marking and cutting of sheet metals to required size. - Practice on bending of plates and pipes to required shape. - Straightening plates and section - Edge planning as per requirement. 	<ul style="list-style-type: none"> - Description and operation of croppers, shearing machine, Guillotine shears, punching machines, Edge planning machine and nibbling machine etc. - Description and operation of straightening machines - Methods of bending plates, angle iron etc. - Cold bending and hot bending etc. - Bending of angles and channels - Press work - Flame straightening methods
13,14	<ul style="list-style-type: none"> - Preparation of pipe joint for high pressure pipe welding - Pipe Welding - preparation of edges – cleaning the joint surface – 	<ul style="list-style-type: none"> - Pipes and pipe fitting – Pipe schedule – types – methods of bending – use of bending fixture – pipe bending machine – use of pipe cutter, pipe

	Fit up the pipes - Tack weld two pipes together - Pipe work – cutting – bending – threading – joining and assembly.	wrenches – pipe vices – pipe threads - pipe dies and taps etc. - Edge preparation for pressure line pipes – Fit up procedure.
15,16	- Preparation of single riveted lap joint - Double riveted lap joint - Single cover plate riveted butt joint - Double cover plate riveted butt joint - Bolted joints .	- Riveting – types of rivets and riveting - Hand riveting, cold and hot – methods of riveting – use of pneumatic riveting, hydraulic riveting – checking rivets – removing of bad rivets - Types of bolts – black bolt, turned bolt, high strength bolt etc. and their application
17,18	- Preparation of pipes for T, Y, K joints - Marking gusset plates - Marking joint section beam - Marking joint column using height gauge - Marking curved and bend plates and section - Marking on built up I section - Usage of pantograph for marking	- Kind of structures – Column base, plate girders, Gantry girders, Root trusses – description, types and use - Beam connection, beam to column connection – framed connection and seated connection - Type of pressure vessels – Boilers, Heat exchangers, High pressure pipe lines etc. - Marking – Marking for cutting to size, marking for beveling and chamfering and marking for pipes and intersection
19,20	- Making templates for cutting to size and simple objects - Making templates for Gussets and joint sections - Making simple fixtures	- Jigs and Template making – Design and description of templates for cutting – templates of gussets – templates for marking angle - Template for marking joint section - Design and development of jigs for drilling and angles - Design of simple fixture and clamping devices
21,22	- Making simple riveted plate assembly – Girder , trusses - Making a simple lattice structure - Making pressure pipe line assembly - Making welded I section assembly - Making cylindrical tanks	- Assembly: Procedure and technique for assembly - Assembling of riveted plates, girders and trusses - Assembly of welded I section - Assembly of cylindrical tanks including fitting and lining of vessels

Week No.	Practical	Theory
23,24	<ul style="list-style-type: none"> - Rectification of distorted welded structure by flame straightening. - Dimensional inspection of fit ups - Non destructive testing - Cleaning and painting 	<ul style="list-style-type: none"> - Distortion & methods of control - Preventing and allowing for weld distortion - Common welding defects - Inspection and testing - Non destructive method of flaw detection – PT, MPT, Ultrasonic & Radiographic inspection - Chipping & Grinding : Chisels & pneumatic chisels used for chipping- Method of chipping and cutting - Types of grinding machines - Grinding wheels - Method of removing welds and rivets by chipping and grinding. - Finishing & Painting : Common types of painting. Stenciling, marking and colour marking
25,26	<i>Review and ALL INDIA TRADE TEST etc</i>	

I) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees

SI No	Item	Qty
1	Steel Rule 300 mm	17
2	Wing Divider 200 mm	17
3	Centre Punch 100 mm	17
4	Spring Dividers 150 mm	17
5	Ordinary Wooden Mallet 50 mm	17

SI No	Item	Qty
6	Cross Peen Hammer 0.25 Kg with handle	17
7	Protractor with blade 150 mm	17
8	Steel Tape 2 meters	17
9	Ballpane Hammer 0.5 Kg with handle	17
10	Scriber 150mm x 3 mm (Engineers)	17

SI No	Item	Qty
SHOP OUT FIT		
11	Steel Square 450mm x 600 mm	4 Nos.
12	Sheet Metal Gauge	2Nos.
13	Stake Round and Bottom	4 Nos.
14	Half Moon Stake	4 Nos.

SI No	Item	Qty
35	File flat 250 mm smooth	2 Nos.
36	File flat 300 mm bastard	2 Nos.
37	File half round 300mm smooth	2 Nos.
38	Hacksaw frame 300 mm adjustable (tubular)	4 Nos.
39	Hand Groover 3 mm, 4mm, 5mm	4 Nos.

15	Funnel Stake	4 Nos.
16	Anvil Face Stake	4 Nos.
17	Bick Iron stake	4 Nos.
18	Tinmans Horse	2 Nos.
19	Hammer Peening with handle	4 Nos.
20	Hammer Creasing with handle	4 Nos.
21	Hammer Planishing with handle	4 Nos.
22	Hammer Block with handle	2 Nos.
23	Tinmans 300 mm	8 Nos.
24	Snips straight 250 mm	8 Nos.
25	Right cut snips 250 mm	4 Nos.
26	Left cut Snips 250 mm	4 Nos.
27	Hand Shear Universal 250 mm	4 Nos.
28	Punch Round 3 mm , 4mm & 6mm Dia	4 Nos
29	Punch Round 4 mm Dia	4 Nos
30	Punch Round 6 mm Dia	4 Nos
31	Rivet sets snap and Dolly combined 3 mm ,4 mm, 6mm	4 Nos each
32	Chisel cold flat 25 mm x 250 mm	4 Nos
33	Punch Letter 4mm and Punch Number 4 mm	1 set each
34	File flat 250 mm second cut and smooth	2 each

40	Plier Combination 150 mm	2 Nos
41	Grip Wrench 200mm	2 Nos
42	Ladle 150 mm Dia	2 Nos
43	Try square 1m	2 Nos
44	H.S.S. Twist Drill 3 mm, 4mm & 6 mm (Parallel Shank)	3 Nos each
45	Hand Drill 0 to 6 mm, 8mm, 10mm & 12mm	2 Nos. each
46	Soldering Copper Hatchet type 500 gms	8 Nos
47	Pneumatic rivet gun	2 Nos.
48	Trammel Point (with beam 600 mm)	1 No.
49	Vernier caliper (0mm – 150mm)	1 No.
50	Micrometer outside (0 to 25mm)	1 No.
51	Raspcut file 250 mm	4 Nos.
52	D.E.Spanner G.P (6 mm to 32 mm) (Set of 12 spanner)	2 set
53	Bessing Mallet	4 Nos
54	Endfaked Mallet	4 Nos
55	Oil Can Pressure feed 500 ml	2 Nos
56	Soft Hammer (Brass, Copper, Lead, Rubber and Rawhide heads with handle)	4 Nos
57	Steel Rule 600mm	4 Nos
58	Raising Hammer with handle	4 Nos
59	Rawl Punch holder and bits (No.8,10, 12,14)	2 sets

SI No	Item	Qty
60	Hollowing Hammbur with handle	4 Nos
61	Tripaning tool 70mm	1 No.
62	Safety Glasses	4 pairs
63	Handvice 50mm	16 Nos.
64	Steel wire Brush 50mm x 150mm	16 Nos.
65	Gloves for Welding (Leather and Asbestos)	16 Nos.
66	Leather Apron	16 Nos.
67	Tongs, Close mouth and pick up (1 each)	4 pairs

SI No	Item	Qty
85	Welding plant Oxy-Acetylene complete (high pressure)	2 Nos
86	Circle Cutting Machine 300 mm Dia	1 No
87	Pillar type drilling machine 12mm	1 No.
88	Slip roll former 1.6mm x 1000 mm	1 No.
89	D.E. Grinder Pedestal motorized 200 mm	1 No.
90	Anvil 50 Kgs with Stand	1 No.
91	Bench vice 120mm, 150mm	2 each
92	Fly press / Ball press No.4 single body	1 No.

68	Portable Electric drill (Single phase)	2 Nos.
69	Crow bar 910 x 25mm	2Nos.
70	Trowel Medium	1 No.
71	Trowel small	1No.
72	Poprivet gun	2 Nos.
73	Lazy Tong	2 Nos.
74	Screw Driver 250mm	2 Nos.
75	Round File 2 nd Cut 250mm	4 Nos.
76	Triangular File Smooth 250mm	4 Nos.
77	Square File 2 nd Cut 250mm	4 Nos.
78	'C' Clamp 150mm	6 Nos

GENERAL INSTALLATION

79	Light General purpose portable forge	2 Nos.
80	Liquified Petroleum Gas (LPG) Cylinder, Regulator and Torch with Burner	2 Nos.
81	Bench lever shears 250mm Blade x 3 mm Capacity	1 No.
82	Air Compressor (Pressure and displacement of air)	1 No.
83	Spray Gun (Painting) 500 ml	1 No.
84	Guillotine Shearing Machine foot operated (1 mt x 18G Capacity)	1 No.

111	Pneumatic wrench with adopter Pipe bend machine Manual with Dies ¼", ½", ¾", 1" , 1¼", 1½" upto 50 mm	1 No
112	Pneumatic Screw Driver with 6 mm, 8mm, 10mm, 16 mm & 25 mm gravity upto 25 mm	1 No
113	Pneumatic Rivetting machine to depth of 50 mm	1 No
114	Pneumatic Drilling machine with bits 4,5,6,8 & 12 mm capacity 1/2mm	1 No
115	Pneumatic Chips 50mm	1 No
116	Pentagrap machine for marking 1 mt Ø	1 No
117	Vernier Height gauge range 500 mm	1 No
118	Surface plate with cover 100cm x 100 cm	1 No

93	Buffing and Polishing Machine	1 No.
94	Nibbling Machine	1 No.
95	Spinning Lathe	1 No.
96	Seaming Machine	1 No
97	Black Board with Easel	1 No
98	Wooden Rule 450 mm	1 No.
99	Portable Nibbler	2 Nos.
100	Portable Pneumatic Shear	2 Nos.
101	Pipe Bending Machine (Hydraulic type) 12mm to 30mm	1 No.
102	Hand Press Brake Capacity (0.8mm)	1 No.
103	Tin smiths bench folder 600 x 1.6mm	1 No.
104	Beading Machine with 380mm throat clearance (with crimping rollers)	1 No
105	Welding Transformer (200 to 400 Amps)	2 No.
106	Gas Welding Table 1220 mm x 760 mm	2 Nos
107	Spot Welding Machine	1 No.
108	Pipe bend machine Manual with Dies ¼", ½", ¾", 1" & 1¼" upto 32 mm	1 No
109	Chain pully hook with lock capacity 1/2 ton	1 No
110	Plate bending machine (Roller type) capacity upto 8 mm thickness	1 No

119	Plums	4 Nos.
120	Hydraulic Trolley Capacity ½ ton	1 No
121	Hydraulic Jack 250 mm Capacity ½ ton	2 Nos.
122	Quick acting clamp capacity 100 Kg	8 Nos.
123	Air compressor capacity 10 Kg/cm ²	1 No.
124	Plain wire 3 mm	20 metres
125	Centre lathe , height of centre 150 mm	1

Workshop furniture		Qty
1	Suitable Work Tables with vices	As required.
2	Stools	17 Nos
3	Discussion Table	1 No
4	Tool Cabinet	2 Nos
5	Trainees locker	2 Nos
6	Fire fighting equipment, first aid box etc	As required
7	Book shelf (glass panel)	1 No.
8	Storage Rack	As required
9	Storage shelf	As required

UPGRADATION OF ITIs into CENTERS of EXCELLENCE (CoE)

SECTOR / AREA : FABRICATION (Fitting & Welding)

ADVANCED MODULE IN II YEAR

(FOR THE FIRST 6 MONTHS OF II YEAR)

MODULE - III : STRUCTURAL WELDING

(Duration - **26 weeks**)

SECTOR / AREA : FABRICATION (Fitting & Welding)
ADVANCED MODULE IN IInd YEAR
MODULE - III: STRUCTURAL WELDING
 (Duration - 26 weeks)

I) COURSE CONTENT

Week No.	Practical	Theory
1,2	<ul style="list-style-type: none"> - Familiarisation with the machinery used in the trade - Introduction to safety equipment and their use - Setting up Gas cutting equipment and cutting MS Flats to required size - Setting up SMAW Welding equipment and making straight and weaving bead on MS in all positions - Practice on plasma cutting - Practice on gouging techniques 	<ul style="list-style-type: none"> - Out line of the subjects to be covered - Importance of structural welding - Welding processes – brief description, Classification and application - Welding terms and definitions - Principles of Oxy-Acetylene Cutting and equipments required. - Principles of shielded metals arc welding, its advantages and limitations. - Types of weld joints.
3,4	<ul style="list-style-type: none"> - Weld joint preparation for fillet welds (cutting to size, fit up, tack weld etc.) - Fillet, Lap and T joint on MS flat by SMAW, position – 1F - Fillet, lap and T joint on MS flat by SMAW position – 2F - Inspection & clearance using LPI testing 	<ul style="list-style-type: none"> - Basic Electricity applicable to welding - Arc welding power source AC / DC - advantages and disadvantages - Types of metal and their characteristics - Classification of steel and their Weldability - Heat affected zone and requirement for pre-heating and maintaining inter pass temperature - Welding symbols and their importance - Welding positions and necessity of positional welding - Weld joint edge preparation - Welding procedure and techniques - Tack welding, root run welding, intermediate and cover pass welding, cleaning, checking etc.

5,6	<ul style="list-style-type: none"> - Weld joint preparation for fillet welds (cutting to size, fit up, tack weld etc.) - Fillet, lap and T joint on MS flat by SMAW, position – 3F - Fillet, lap and T joint on MS flat by SMAW position – 4F - Inspection & clearance using LPI testing 	<ul style="list-style-type: none"> - Welding tools and accessories - Arc and its characteristics - Polarity types and application - Arc length - Welding fixtures and clamps - Coated electrodes - Types, description and coding as per BIS,AWS etc. - Standard size and length of electrodes - Selection of electrodes and coating factor <p>Electrode storage and necessity of backing</p>
7,8	<ul style="list-style-type: none"> - Weld joint preparation for pipe fillet welding - Pipe to plate fillet weld flange joint on MS by SMAW, position – 5 F - Pipe to pipe fillet weld on MS pipes by SMAW, position -5F 	<ul style="list-style-type: none"> - Effect of Heat on Weldments - Welding distortion and stresses - Methods of controlling distortion by various methods - Methods of relieving stress on Weldments <p>Advantages of welded structures over riveted structures</p>
9,10	<ul style="list-style-type: none"> - Weld joint preparation for plate groove welding - Full penetration Single "V" butt joint on MS Flat by SMAW in 1G & 2G Positions - Full penetration single "V" butt joint on MS Flat by SMAW in 3G & 4G Positions - Root pass welding & LPI testing - Cover pass welding & inspection 	<ul style="list-style-type: none"> - Types of Steel sections / forms used in structural fabrication and their standard sizes - Importance of structural welding and workmanship - Necessity of Qualifying welders, welding operators and tack welders - Necessity of Qualifying the welding procedure - Positions of test plates for fillet welds and groove welds - Types of Fillet welded and groove welded joints on statically loaded structures. - Types of fillet welded and groove welded joints on dynamically loaded structures
11,12	<ul style="list-style-type: none"> - Setting up DC TIG welding equipment and making beading practice on MS in down hand position - Square butt joint on M.S Sheet by TIG Welding in down hand position 	<ul style="list-style-type: none"> - TIG Welding equipments - Advantages of TIG Welding process - Power source types AC/DC - Types of polarity and application - Accessories – HF unit and DC Suppressor - Tungsten electrode, types, sizes and uses - Types of shielding gases

		<ul style="list-style-type: none"> - TIG Welding parameters for welding MS
13,14	<ul style="list-style-type: none"> - Full penetration Single "V" butt on M.S. flat by TIG and SMAW, positions 1G & 2G - Root pass welding by TIG & LPI testing - Cover pass by SMAW, inspection & clearance 	<ul style="list-style-type: none"> - Necessity of root pass welding by TIG. - Inspection of root pass welding by die – penetrant testing - Preparation for TIG Welding under drift conditions - Necessity of back purging
15,16	<ul style="list-style-type: none"> - Full penetration Single "V" butt joint on M.S. Flat by TIG and SMAW, positions 3G & 4 G - Root pass welding by TIG & LPI testing - Cover pass by SMAW, inspection & clearance 	<ul style="list-style-type: none"> - Types of Tubular structures used on structural fabrication - Development of templates for marking and preparation of pipe elbow, T, Y and K joints (Similar and dissimilar diameter pipe connections)
17,18	<ul style="list-style-type: none"> - Double "V" butt joint on MS Flats in dissimilar thickness in down hand positions by SMAW - Root Inspection - Back Gouging - Adopting weld sequence for controlling distortion 	<ul style="list-style-type: none"> - Welding defects causes and remedy. - Procedure of rectifying, weld defects – Gouging methods / grinding, testing with die penetrant, pre-heating and re welding
19,20	<ul style="list-style-type: none"> - Pipe Elbow and T joints on MS pipes by SMAW in flat position - Pipe Y and K connection on M.S. pipe by SMAW, positions – Horizontal 	<ul style="list-style-type: none"> - Procedure of structural fabrication - Planning for structural members, marking and edge preparation, assembling, tack welding, measurement of weldment size, root pass welding, inspection of root pass welding, making cover pass and Inspection & Testing etc.
21,22	<ul style="list-style-type: none"> - Practice on CO2 welding and Flux Cored Arc Welding - Practice on Automatic Submerged Arc Welding machine 	<ul style="list-style-type: none"> - Introduction to MIG / Flux cored arc welding – Advantages – Power source – Wire feeder – Electrode wires - shielding gases – Types of metal transfer and welding parameters - Introduction to Submerged arc welding (SAW). Advantage, limitation, Equipment and operating conditions.

Week No.	Practical	Theory
23,24	<ul style="list-style-type: none"> - Manufacturing of simple structures with L angles, I section and channel sections using welding fixture by SMAW. - Correction of distortion by cold / hot method - Manufacturing of I – Section using M.S. Flat by SMAW - Adapting skip welding / back step welding method for controlling distortion - Preparation of WPS & PQR - Weld test specimen – preparation as per a standard - Inspection & Testing 	<ul style="list-style-type: none"> - Types of welding defects, cause and remedy - Inspection and testing of weldments - Visual inspection kits and Gauges - Non-destructive testing methods - Structural welding codes and standards - Writing procedure for WPS and PQR - Requirement for qualification in different codes - Qualification procedure under various codes - Different tests and inspection involved in qualification
25,26	<i>Review and ALL INDIA TRADE TEST etc</i>	

II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees

Sl. No.	Description of tools	QTY
List of Hand Tools		
1	Gloves pair leather	17 Nos
2	Apron leather	17 Nos
3	Screen welding helmet type	17 Nos
4	Screen welding hand	17 Nos
5	Goggles pair welder	17 Nos
6	Hammer scaling 0.25 kg. With handle	17 Nos

Sl. No.	Description of tools	QTY
14	Chipping screen hand	17 Nos
15	Safety boots for welders	17 Nos

Sl. No.	Description of tools	QTY
7	Chisel cold flat 19 mm	17 Nos
8	Centre punch 9mm x 127 mm	17 Nos
9	Dividers 20 cm	17 Nos
10	Caliper outside 15 cm	17 Nos
11	Rule 60 cm two fold brass tipped to read inches and mm	17 Nos
12	Wire brush (M.S)	17 Nos
13	Spark lighter	17 Nos

Sl. No.	Description of tools	QTY
35	Clamps 10 cm 15 cm 20 cm 30 cm	2 each
36	Hammer sledge double faced 3 Kg.	1

16	Safety goggles	17 Nos
17	Square blade 15 cm	17 Nos
18	Scriber 15 cm	17 Nos
19	Tongs holding 30 cm	17 Nos
20	Wire brush (S.S)	17 Nos
List of Shop Outfit		
21	Brass Rule 30 cm or nickel chrome steel rule 30 cm	4
22	Hammer ball pin 1 Kg with handle	4
23	Chisel cold cross 9 mm	1
24	Screw Driver 25 cm blade and 20 cm blade	1 each
25	Leg vice on stand 150 mm	1
26	Number punch 6 mm and letter punch 6 mm	1 set
27	Hacksaw frame adjustable 30 cm	4
28	Hammering blocks 5 cm thick 60 sq	2
29	Magnifying glass x 6	4
30	Weld measuring gauge fillet and universal	2
31	File half round bastard 30 cm	6
32	File flat 35 cm rough	6
33	Spanner 12 mm and 15 mm double ended	4
34	Spanner D E 6 mm to 15 mm be 1.5 mm set of Nos.	1 set

Sl. No.	Description of tools	QTY
List of General Installation		
56	Transformer welding set with all accessories 300 A	1 set
57	Arc welding set Rectifier type 400 Amp. with all accessories.	1 set

37	Pipe wrench 25 cm and 35 cm	1 each
38	Steel tape 10m flexible in case	1
39	"Tinmans" square 60cm x 30 cm	1
40	Earth clamps	12
41	Pipe Cutter	1 set
42	Cutting torch Oxy-Acetylene with cutting nozzle	2 set
43	Heavy duty cutting, blow pipe with cutting nozzles	1 set
44	Electrode holder 400 amps	6
45	Welding rubber hose, oxygen and acetylene 8 mm	100 mte
46	Rubber hose clips	50
47	Spindle key (for opening cylinder valve)	8
48	Pressure regulator oxygen double stage	8
49	Pressure regulator acetylene Regulators	8
50	Tip cleaner	8
51	Glasses coloured 108 x 82 x 3 mm DIN 9A 11 A & 13 A	16 each
52	Glass white 108 mm x 82 mm	20 dozen
53	Outfit spanner	8
54	Rubber hose pipe black and red 5 mm	30 mte
55	Leather sleeves	16 pairs

Sl. No.	Description of tools	QTY
73	Steel lockers with 8 pigeon holes	2
74	Dye penetrant Testing kit	2 set
75	Magnetic particle Testing machine	1

58	CO ₂ welding machine complete 400 amps (Inverter type)	1 set
59	TIG welding set complete 300 amps AC/DC	1 set
60	Welding cables to carry 400 amps with flexible rubber	50 mte
61	Lugs for Cables	4 nos
62	Gas welding table 822 x 92 cm + 60 cm fire bricks on stand	3
63	Arc welding table all metal with positioner	6
64	Trolley for cylinder (H P unit)	2
65	Bench shear hand capacity up to 5 mm	1
66	D E grinder 30 cm wheel motorized Pedestal type	1
67	Vice bench 10 cm	6
68	Power hacksaw	1
69	Electrode drying oven Temp. range 0-250° C, 10Kg. cap.	1
70	AG 7 Grinder & AG4	2 each
71	Portable drilling machine (Cap. 6 mm)	1
72	Welding helmets	16

76	Ultrasonic flaw detector	1
77	IIW / ASTM reference radiograph standard	1 set
78	Submerged Arc welding machine – 600 Amps	1
79	Spot welding machine – 15 KVA	1
80	Universal Testing machine	1
81	Personnel Computer with latest profile	1
82	Welding CDs (Processes and Inspection methods)	1 set
83	Fibre Welding booth & welding screen	8 each
84	Fume extractors	4
85	Oxygen, Acetylene, Argon & CO ₂ cylinders	2 each
86	Fire fighting equipment & First aid box	As reqd
87	Pug cutting machine	1
88	Centre lathe, Height of centre 150 mm with standard accessories	1
89	Air plasma cutting system with accessories & compressor	1
90	Carbon arc gouging torch 300 A	1

Workshop furniture		Qty
1	Suitable Work Tables with vices	As required.
2	Stools	17 Nos
3	Discussion Table	1 No
4	Tool Cabinet	2 Nos
5	Trainees locker	2 Nos
6	Fire fighting equipment, first aid box etc	As required
7	Book shelf (glass panel)	1 No.
8	Storage Rack	As required
9	Storage shelf	As required

UPGRADATION OF ITIs into CENTERS of EXCELLENCE (CoE)

SECTOR / AREA : FABRICATION (Fitting & Welding)

ADVANCED MODULE IN II YEAR (FOR THE FIRST 6 MONTHS OF II YEAR)

MODULE - IV : PRESSURE VESSEL and PIPE WELDING (Duration - **26 weeks**)

SECTOR / AREA : FABRICATION (Fitting & Welding)

ADVANCED MODULE IN IInd YEAR

MODULE IV: PRESSURE VESSEL & PIPE WELDING

(Duration - 26 weeks)

I) COURSE CONTENT

Week No.	Practical	Theory
1,2	<ul style="list-style-type: none"> - Familiarisation with the machinery used in the trade - Safety equipments and their use - Setting up of Arc Welding and Gas Cutting plants - Striking and making straight and weaving beads in all position by SMAW. - Cutting practice of M.S. plates using gas and plasma cutting methods - Gouging practice 	<ul style="list-style-type: none"> - Outline of the subjects to be covered - Importance of pressure vessels and pipe welding - Introduction to various types of welding processes - Advantages and Limitation - Welding term and Definitions - Types of welded joints - Gas welding and cutting - Safety in welding
3,4	<ul style="list-style-type: none"> - Weld joint preparation on plate – Butt and Fillet welds - Square butt joint on MS plate in down hand position - Fillet weld on M.S. Plate in down hand position 	<ul style="list-style-type: none"> - Principles of Shielded Metal Arc Welding (SMAW) - Basic electricity applicable to welding - Types of power source - Polarity and its effects - Arc length - Welding positions and importance
5,6	<ul style="list-style-type: none"> - Edge preparation for plate groove welding - Fit up of joints by tack welding using simple fixtures - Groove welding on plate in 1G & 2G positions - Inspection and clearance using LPI testing during Root pass and 	<ul style="list-style-type: none"> - Edge preparation and tack welding procedure - Welding fixtures and clamps - Electrodes – types – description and specification – BIS, AWS, etc. - Functions of flux and characteristic of flux

	cover pass	
7,8	<ul style="list-style-type: none"> - Groove welding on plate in 3G & 4G positions - Inspection and clearance using LPI testing during Root pass and cover pass 	<ul style="list-style-type: none"> - Selection of electrodes (Rutile / Cellulosic / Lowhydrogen etc.) & coating factors - Electrode storage and backing temperature - Types of metals and their characteristics - Classification of steels
9,10	<ul style="list-style-type: none"> - Preparation of pipe joint for pipe welding (schedule 60 / 80). - Prepare the edges , Clean the joint surfaces, Fit up the pipes and tack weld the pipes - Fit up inspection 	<ul style="list-style-type: none"> - Introduction to pipe welding - Types of pipes and pipe schedule - Basic pipe welding procedure – uphill welding, down hill welding and horizontal welding - Preparation work before welding
11,12	<ul style="list-style-type: none"> - Welding of pipes in 1G & 2G position - Root welding of pipes in 5G position - Intermediate and cover pass welding in 5G points - Inspection and clearance using LPI testing 	<ul style="list-style-type: none"> - Pipe welding position 1G, 2G, 5G & 6G - Selection of electrode (SMAW) for root pass and cover pass welding - Procedure for welding heavy wall pipes in 5G position welding.
13, 14	<ul style="list-style-type: none"> - Root welding of pipes in 6G position - Intermediate and cover pass welding in 6G position - Inspection and clearance using LPI testing 	<ul style="list-style-type: none"> - Procedure for welding heavy wall pipes in 6G position welding - Welding symbols
15,16	<ul style="list-style-type: none"> - Pipe and plate flange joint welding - T & Y pipe joint welding 	<ul style="list-style-type: none"> - Procedure for welding of thin wall pipes in downhill position - Procedure for welding pipes in 2G position - Welding procedure for complicated pipe joint, T-joints with intersection Top, Bottom and Side – Y joint etc.
17,18	<ul style="list-style-type: none"> - Beading practice by TIG on MS sheets 	<ul style="list-style-type: none"> - Introduction to TIG welding – Advantages, Equipment – Electrode –

	<ul style="list-style-type: none"> - Root pass welding of plates and pipes in all positions by TIG - Cover pass by SMAW 	Shielding Gas and Advantage of root pass welding by TIG
19,20	<ul style="list-style-type: none"> - Practice on CO₂ welding and Flux Cored Arc Welding - Practice on Automatic Submerged Arc Welding machine 	<ul style="list-style-type: none"> - Introduction to MIG / Flux cored arc welding – Advantages – Power source – Wire feeder – Electrode wires - shielding gases – Types of metal transfer and welding parameters - Introduction to Submerged arc welding (SAW). Advantage, limitation, Equipment and operating conditions.
21,22	<ul style="list-style-type: none"> - Dimensional inspection of weldments - Visual inspection of weldments - Non-destructive testing of weldments 	<ul style="list-style-type: none"> - Types of welding defects, cause and remedy - Inspection and testing of weldments - Visual inspection kits and Gauges - Non-destructive testing methods - Welding metallurgy – weld stress - Distortion and control. - Correction of distorted section - Importance of preheating, post heating and post weld heat treatment
23,24	<ul style="list-style-type: none"> - Preparation of WPS & PQR - Weld test specimen preparation on plates and pipes according to Codes and standards - Testing of specimen according to codes and standards 	<ul style="list-style-type: none"> - Pressure welding codes and standards (IBR, ASME etc.) - Writing procedure for WPS and PQR - Grouping of metals and filler rods (P & F number) - Requirement for qualification in different codes - Qualification procedure under various codes - Different tests and inspection involved in qualification
25,26	Review and ALL INDIA TRADE TEST etc	

II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees

Sl. No.	Description of tools	QTY
List of Hand Tools		
1	Gloves pair leather	17 Nos
2	Apron leather	17 Nos
3	Screen welding helmet type	17 Nos
4	Screen welding hand	17 Nos
5	Goggles pair welder	17 Nos
6	Hammer scaling 0.25 kg. With handle	17 Nos
7	Chisel cold flat 19 mm	17 Nos
8	Centre punch 9mm x 127 mm	17 Nos
9	Dividers 20 cm	17 Nos
10	Caliper outside 15 cm	17 Nos
11	Rule 60 cm two fold brass tipped to read inches and mm	17 Nos
12	Wire brush (M.S)	17 Nos
13	Spark lighter	17 Nos
14	Chipping screen hand	17 Nos
15	Safety boots for welders	17 Nos
16	Safety goggles	17 Nos
17	Square blade 15 cm	17 Nos
18	Scriber 15 cm	17 Nos
19	Tongs holding 30 cm	17 Nos
20	Wire brush (S.S)	17 Nos

Sl. No.	Description of tools	QTY
List of Shop Outfit		
21	Brass Rule 30 cm or nickel chrome steel rule 30 cm	4
22	Hammer ball pin 1 Kg with handle	4
23	Chisel cold cross 9 mm	1
24	Screw Driver 25 cm blade and 20 cm blade	1 each
25	Leg vice on stand 150 mm	1
26	Number punch 6 mm and letter punch 6 mm	1 set
27	Hacksaw frame adjustable 30 cm	4
28	Hammering blocks 5 cm thick 60 sq	2
29	Magnifying glass x 6	4
30	Weld measuring gauge fillet and butt	2
31	File half round bastard 30 cm	6
32	File flat 35 cm rough	6
33	Spanner 12 mm and 15 mm double ended	4
34	Spanner D E 6 mm to 15 mm be 1.5 mm set of Nos.	1 set
35	Clamps 10 cm 15 cm 20 cm 30 cm	2 each
36	Hammer sledge double faced 3 Kg.	1
37	Pipe wrench 25 cm and 35 cm	1 each
38	Steel tape 182 cm flexible in case	1
39	"Tinmans" square 60cm x 30 cm	1
40	Wire cutter	2

Sl. No.	Description of tools	QTY
41	Earth clamps	12
42	Pipe Cutter	1
43	Cutting torch Oxy-Acetylene with cutting nozzle	2 set
44	Heavy duty cutting, blow pipe with cutting nozzles	1 set
45	Electrode holder 400 amps	6
46	Welding rubber hose, oxygen and acetylene 8 mm	100 mtr
47	Rubber hose clips	50
48	Spindle key (for opening cylinder valve)	8
49	Pressure regulator oxygen double stage	8
50	Pressure regulator acetylene Regulators	8
51	Tip cleaner	8
52	Glasses coloured 108 x 82 x 3 mm DIN 9A 11 A & 13 A	16 each
53	Glass white 108 mm x 82 mm	20 dozen
54	Outfit spanner	8
55	Rubber hose pipe black and red 5 mm	30 mte
56	Leather sleeves	16 pairs
List of General Installation		
57	Transformer welding set with all accessories 300 A	1 set
58	Arc welding set Rectifier type 400 Amps with all accessories.	1 set
59	CO ₂ welding machine complete 400 amps	1 set
60	TIG welding set complete 300 amps AC/DC	1 set
61	Welding cables to carry 400 amps with flexible rubber	50 mte

Sl. No.	Description of tools	QTY
62	Lugs for Cables	4 nos
63	PUG cutting machine	1
64	Gas welding table 822 x 92 cm + 60 cm fire bricks on stand	3
65	Arc welding table all metal with positioner	6
66	Trolley for cylinder (H P unit)	2
67	Bench shear hand capacity up to 5 mm	1
68	D E grinder 30 cm wheel motorized Pedestal type	1
69	Vice bench 10 cm	6
70	Power hacksaw	1
71	AG 7 Grinder & AG4	2 each
72	Portable drilling machine (Cap. 6 mm)	1
73	Electrode drying oven Temp. range 0-250° C, 10Kg cap.	1
74	Welding helmets	16
75	Steel lockers with 8 pigeon holes	2
76	Dye penetrant Testing kit	2 set
77	Magnetic particle Testing machine	1
78	Ultrasonic flaw detector	1
79	Reference Radiographic standard	1 set
80	Submerged Arc welding machine – 600 Amps	1
81	Impact testing machine	1
82	Air plasma cutting system with standard accessories & air compressor	1
83	Universal Testing machine	1

Sl. No.	Description of tools	QTY
84	Personnel Computer with latest profile	1
85	Welding CDs (Processes and Inspection methods)	1 set
86	Fibre Welding booth & welding screen	8 each
87	Fume extractors	4

Sl. No.	Description of tools	QTY
88	Oxygen, Acetylene, Argon & Co ₂ cylinders	2 each
89	Fire fighting equipment & First aid box	As reqd.
90	Centre lathe swing over dia 10"	1
91	Gullitine shearing machine	1

Workshop furniture		Qty
1	Suitable Work Tables with vices	As required.
2	Stools	17 Nos
3	Discussion Table	1 No
4	Tool Cabinet	2 Nos
5	Trainees locker	2 Nos
6	Fire fighting equipment, first aid box etc	As required
7	Book shelf (glass panel)	1 No.
8	Storage Rack	As required
9	Storage shelf	As required

UPGRADATION OF ITIs into CENTERS of EXCELLENCE (CoE)

SECTOR / AREA : FABRICATION (Fitting & Welding)

ADVANCED MODULE IN II YEAR

(FOR THE FIRST 6 MONTHS OF II YEAR)

MODULE - V : WELDING INSPECTION and TESTING

(Duration - **26 weeks**)

Advanced MODULE IN IInd YEAR

MODULE - V: WELDING INSPECTION and TESTING

(Duration - 26 weeks)

I) COURSE CONTENT

Week No.	Practical	Theory
1,2	<ul style="list-style-type: none"> - Familiarisation with the machinery / instruments used in the trade - Handling of measuring instruments – Steel tape, Vernier Caliper, spirit level, micrometer, Try square, Plum drop etc. - Simple dimensional measurements using the appropriate instruments 	<ul style="list-style-type: none"> - Outline of various subjects to be covered - Quality and its definition - Inspection methods - Measuring Instruments and least count - Dimension report preparation - Types of metals & characteristics - Classification of steels
3,4	<ul style="list-style-type: none"> - Identification of materials - Setting up of Gas welding equipment - Simple gas welding exercises on sheet metals (Butt & Fillet welds) 	<ul style="list-style-type: none"> - Types of welding process - Advantages & limitations - Various types of welding power sources - Welding parameters - Different types of weld joints - Gas welding principle and application - Safety in welding and cutting
5,6	<ul style="list-style-type: none"> - Lay out marking on plates - Marking on structural sections – I, L, C etc. - Development marking for cylinders - Gas cutting of MS plate, I section and channels - Profile cutting 	<ul style="list-style-type: none"> - Marking with pantograph - Gas cutting principles, basic CNC profile cutting - Different size and shape of rolled sections - Basic welding metallurgy (pre heating, post heating etc.) - Welding symbol and its nomenclatures

7,8	<ul style="list-style-type: none"> - Setting up of Arc welding equipment - Making square butt joint on MS sheet in down hand position by SMAW - Making single V - Butt joint on MS sheet in down hand position by SMAW - Use of backing strip for root run welding 	<ul style="list-style-type: none"> - Principle of Shielded metal Arc welding (SMAW) - AC / DC power source advantages and disadvantages. - Arc and its characteristics - Electrode – Types, description & Specification – BIS, AWS etc.. - Function of flux and baking requirements - Selection of electrodes and coating factors - Different type of edge preparation - Welding procedure – Edge preparation and fitup, use of backing strips and bars, root run welding and cover pass welding
9,10	<ul style="list-style-type: none"> - Setting up TIG / MIG welding plant. - Beading practicing by TIG / MIG - Square butt and corner joint on SS by TIG - Butt, T and Corner joint on Aluminium sheet by TIG - Straight line beads on MS plate by CO₂ welding - Lap T & corner joint on MS plate by CO₂ welding - Single V – Butt joint by CO₂ welding 	<ul style="list-style-type: none"> - Introduction to TIG welding - TIG welding equipments - Advantages of TIG welding process - Accessories - HF unit and DC suppressor. - Tungsten electrode, Types, sizes, and uses. - Type of shielding gases - Purging Methods - Parameter setting - MIG / MAG welding process - Power source & accessories - Wire Feed unit - Modes of metal transfer – Dip, Globular, spray & pulsed transfer and its significance - Welding wire types and specification & Parameter setting
11,12	<ul style="list-style-type: none"> - Pipe weld joint fit up on elbow and T- joint - Pipe joint root welding by TIG - Pipe joint covering pass welding by SMAW 	<ul style="list-style-type: none"> - Different types of pipes and tubes - Various types of pipe joints - Development of pipe – elbow and T- joint - Various equipments used for root pass cleaning - Pipe bending - Pipe welding procedure

13,14	<ul style="list-style-type: none"> - Identification of different types of weld defects from weld joints - Dimensional inspection of weldments using weld and weldments measuring gauges 	<ul style="list-style-type: none"> - Types of Welding defects (Cracks, Inclusions, Incomplete penetration, Lack of fusion, Under cut, Burn through, Overlap etc.) - Causes for defects. - Remedial measures - Inspection methods
15,16	<ul style="list-style-type: none"> - Hardness Testing - Bend Testing of Weldments - Tensile testing 	<ul style="list-style-type: none"> - Mechanical Testing of Metals. - Principles, Applications of - Hardness testing (Rockwell and Brinell) - Impact testing (Izod and Charpy) - Tensile testing and Bend Test
17,18	<ul style="list-style-type: none"> - Evaluation of welding defects using Dye penetrant testing method and Magnetic Particle Testing 	<ul style="list-style-type: none"> - Non destructive Testing of Metals. - Visual inspection - Dye penetrant test - Principles - Advantages - Limitations - Types of Penetrants - Cleaners - Dwelling time - - Magnetic Particle Test - Principles - Advantages - Limitations - Types of Magnetation - Current requirements - Testing equipments - Indication and Interpretations
19,20	<ul style="list-style-type: none"> - Evaluation of welding defects using Ultrasonic Flaw detector 	<ul style="list-style-type: none"> - Ultrasonic Testing – Principles – Advantage – Limitation - Types of UT Waves – Attenuation - Types of Transducers - Couplants - Equipments and controls - Type of scans - Measuring Techniques - Standard reference blocks - Contact Testing procedure - Indications and interpretations
21,22	<ul style="list-style-type: none"> - Study of IIW / ASTM reference Radiograph - Interpretation of Radiographic films 	<p>Radiographic testing - Principles – Advantages – Limitations - Basic Radiation Physics - X-Rays - Gama Rays - Radiation Sources - Types of Films - Film Processing - Radiographic Sensitivity - Image Quality indicators - Radiographic Techniques - Radiographic Interpretation and Evaluation - Radiation Hazard and Control</p>

Week No.	Practical	Theory
23,24	<ul style="list-style-type: none"> - Preparation of welding inspection reports - WPS & PQR writing procedure 	<ul style="list-style-type: none"> - Certification methods for welding inspectors - Codes and standards for welding inspection - Structural welding codes - Pressure vessel welding codes - Welding procedure specifications (WPS) - Procedure qualification Record (PQR)
25,26	<i>Review and ALL INDIA TRADE TEST etc</i>	

II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees

Sl. No.	Description of tools	QTY
List of Hand Tools		
1	Gloves pair leather	17 Nos
2	Apron leather	17 Nos
3	Screen welding helmet type	17 Nos
4	Screen welding hand	17 Nos
5	Goggles pair welder	17 Nos
6	Hammer scaling 0.25 kg. With handle	17 Nos
7	Chisel cold flat 19 mm	17 Nos
8	Centre punch 9mm x 127 mm	17 Nos
9	Dividers 20 cm	17 Nos
10	Caliper outside 15 cm	17 Nos

Sl. No.	Description of tools	QTY
List of Shop Outfit		
11	Rule 60 cm two fold brass tipped to read inches and mm	17 Nos
12	Wire brush (M.S)	17 Nos
13	Spark lighter	17 Nos
14	Chipping screen hand	17 Nos
15	Safety boots for welders	17 Nos
16	Safety goggles	17 Nos
17	Square blade 15 cm	17 Nos
18	Scriber 15 cm	17 Nos
19	Tongs holding 30 cm	17 Nos
20	Wire brush (S.S)	17 Nos

Sl. No.	Description of tools	QTY
List of Shop Outfit		
21	Brass Rule 30 cm or nickel chrome steel rule 30 cm	4
22	Hammer ball pin 1 Kg with handle	4
23	Chisel cold cross 9 mm	1
24	Screw Driver 25 cm blade and 20 cm blade	1 each
25	Leg vice on stand 150 mm	1
26	Number punch 6 mm and letter punch 6 mm	1 set
27	Hacksaw frame adjustable 30 cm	4
28	Hammering blocks 5 cm thick 60 sq	2
29	Magnifying glass x 6	10
30	Weld measuring gauge fillet and universal	4 each
31	File half round bastard 30 cm	6
32	File flat 35 cm rough	6
33	Spanner 12 mm and 15 mm double ended	4
34	Spanner D E 6 mm to 15 mm be 1.5 mm set of Nos.	1 set
35	Clamps 10 cm 15 cm 20 cm 30 cm	2 each
36	Hammer sledge double faced 3 Kg.	1
37	Pipe wrench 25 cm and 35 cm	1 each
38	Steel Measuring tape 10 m flexible in case	4
39	"Tinmans" square 60cm x 30 cm	1
40	Inspection lamp	4
41	Earth clamps	12

Sl. No.	Description of tools	QTY
42	Cutting torch Oxy-Acetylene with cutting nozzle	2 set
43	Heavy duty cutting, blow pipe with cutting nozzles	1 set
44	Electrode holder 400 amps	6
45	Welding rubber hose, oxygen and acetylene 8 mm	100 mte
46	Rubber hose clips	50
47	Spindle key (for opening cylinder valve)	8
48	Pressure regulator oxygen double stage	8
49	Pressure regulator acetylene Regulators	8
50	Tip cleaner	8
51	Glasses coloured 108 x 82 x 3 mm DIN 9A 11 A & 13 A	16 each
52	Glass white 108 mm x 82 mm	20 dozen
53	Outfit spanner	8
54	Rubber hose pipe black and red 5 mm	30 mte
55	Leather sleeves	16 pairs
List of General Installation		
56	Transformer welding set with all accessories 300 A	1 set
57	Arc welding set Rectifier type 400 Amp. with all accessories.	1 set
58	CO ₂ welding machine complete 400 amps with gas cooled goose necked welding gun – 300 A	1 set
59	TIG welding set complete 300 amps AC / DC with water cooled torch	1 set
60	Welding cables to carry 400 amps with flexible rubber	50 mte
61	Lugs for Cables	4 nos
62	Gas welding table 822 x 92 cm + 60 cm fire bricks on stand	3

Sl. No.	Description of tools	QTY
63	Arc welding table all metal with positioner	6
64	Trolley for cylinder (H P unit)	2
65	Bench shear hand capacity up to 5 mm	1
66	D E grinder 30 cm wheel motorized Pedestal type	1
67	Vice bench 10 cm	6
68	Power hacksaw	1
69	Electrode drying oven Temp. range 0-250° C, 10Kg cap.	1
70	AG 7 Grinder & AG4	2 each
71	Portable drilling machine (Cap. 6 mm)	1
72	Welding helmets	16
73	Steel lockers with 8 pigeon holes	2
74	Dye penetrant Testing kit	4 set

Sl. No.	Description of tools	QTY
75	Magnetic particle Testing machine	4
76	Ultrasonic flaw detector	4
77	IIW / ASTM reference radiograph standard	1 set
78	Universal Testing machine	1
79	Personnel Computer with latest profile	1
80	Welding CDs (Processes and Inspection methods)	1 set
81	Fibre Welding booth & welding screen	8 each
82	Fume extractors	4
83	Oxygen, Acetylene, Argon & CO ₂ cylinders	2 each
84	Fire fighting equipment & First aid box	As reqd
85	Hardness testing machine (Rockwell & Brinell)	1 each

Workshop furniture		Qty
1	Suitable Work Tables with vices	As required.
2	Stools	17 Nos
3	Discussion Table	1 No
4	Tool Cabinet	2 Nos
5	Trainees locker	2 Nos
6	Fire fighting equipment, first aid box etc	As required
7	Book shelf (glass panel)	1 No.
8	Storage Rack	As required
9	Storage shelf	As required